BRIEFER ARTICLES

APOGAMY IN NEPHRODIUM HERTIPES

PRELIMINARY NOTE

Several cultures of *Nephrodium hertipes* were made beginning December 14, 1913. The spores were collected from plants grown in the university greenhouse and were sown on sphagnum placed in small stender dishes and then saturated with a 0.1 per cent Knop's solution. Before the spores were sown, the dishes containing the medium were thoroughly sterilized in an oven. The prothallia were grown under favorable conditions of nutrition, illumination, moisture, and temperature. While the sex organs were developing on the prothallia of other species under these conditions, it was observed that only an occasional prothallium of this fern produced antheridia. Archegonia were never seen on any of the prothallia.

In April 1914, many of the prothallia in the oldest culture were typically heart-shaped. A microscopical examination made at this time showed that embryos of apogamous origin had begun their development. When the embryo is about to make its appearance, usually a small light area, just back of the apical notch, is formed. This appearance is due to the fact that only a few chromatophores are present in the cells of this part of the prothallium as compared with the larger number present in the neighboring prothallial cells. Tracheids appear in the paler portion of the prothallium just described. The light region gradually increases in extent. Where the tracheids are formed, a compact mass of cells is produced which develops into the apogamous embryo. A foot is never formed by the developing embryo. The primary leaf first makes its appearance, then the primary root, and later the stem. In this order of development of the parts of the embryo, *Nephrodium hertipes* resembles some other apogamous ferns thus far described. In some cases, however, the root appears before the leaf. On large, much-branched prothallia several apogamous embryos may begin to develop. Some of these abort and seldom more than one embryo on a prothallium reaches an advanced stage.

Occasionally cylindrical growths, often containing tracheids, are produced from the prothallia. As growth proceeds, these sporophyte-like portions flatten out at the growing ends and assume the form of

ordinary prothallia, which may in their turn produce apogamous embryos. In all my cultures apogamous embryos have been produced in large numbers. From observations so far made it appears that all the prothallia may produce such embryos. Some of the young sporophytes have been grown to a height of several inches and are apparently normal in every respect.

An investigation of the nuclear history of this species led to the discovery of cell and nuclear fusions in the sporangia, similar to those described for the first time by Miss RUTH ALLEN in *Aspidium falcatum*, and not thus far described in any other fern. Nothing unusual has been observed in the early stages in the development of the sporangia. By four successive divisions 16 cells are formed from the primary sporogenous cell. These cells instead of functioning as spore mother cells, as do the cells of the corresponding cell generation in the sporangia of most of the Polypodiaceae, fuse in pairs. Sometimes the wall between two neighboring cells completely disappears before the fusion of the nuclei. Frequently only a portion of the walls disappears before the fusion of the nuclei is completed, but as a rule they wholly disappear later.

The 8 cells produced by the fusions just described are the ones that function as the spore mother cells. Heterotypic and homoeotypic divisions occur, forming typically 32 spores. The mature sporangium, however, frequently contains fewer than 32 spores. Irregularities occurring in sporogenesis may account for the presence of the smaller number of spores in a sporangium. Spore mother cells in synapsis, various stages in the divisions of the spore mother cells, and tetrads are sometimes found at the same time in a single sporangium. This is out of harmony with the usual course of events in fern sporangia, and it is possible that some of the cells in the earlier stages of development may fail to complete their division. Occasionally cell and nuclear fusions are not completed. It is highly probable that the number of spores in a sporangium is frequently reduced by these irregularities and abnormalities among the spore mother cells.—W. N. STEIL, *University of Wisconsin, Madison, Wisconsin.*